Introduction

to

SHORT WAVE THERAPY

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SHORT WAVE DIATHERMY

INTRODUCTION
TO
SHORT WAVE DIATHERMY

NATURE, CLINICAL INDICATIONS, THERAPEUTIC TECHNIC

ILLUSTRATIONS

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PREFACE

Since the introduction of short wave diathermy into medical practice, an increasing number of our medical friends have asked us to recommend to them a brief, yet authoritative, guide to the clinical application of this new modality. Nowhere was such a book available.

The following exposition, accordingly, has been prepared at our request through the cooperation of several outstanding authorities who are thoroughly familiar with this latest addition to physical therapy and who appreciate the needs of every-day practice. A study of this small volume will show that the subject-matter has been presented step by step and in a manner that will prove, we hope, most useful to physicians and surgeons. The purpose has not been to present an exhaustive treatise but rather a concise statement of present-day knowledge of short waves and their use.

It is hardly necessary to add that this book is written from a scientific point of view. The authors were instructed to present known facts without prejudice. They had at hand, not only their own extensive experience with short wave diathermy, but also a complete library of present-day literature on the subject, domestic and foreign.

Research on short wave diathermy, naturally, continues. Special researches are being carried on for us in a number of leading universities and medical schools and elsewhere, including important individual physicians.

We offer this book in a spirit of helpfulness. We believe it will prove a worthy aid to earnest practitioners, in overcoming technical as well as theoretic difficulties, and enable them to bring to their patients the full benefits of this exceedingly valuable method of high frequency therapy.

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Chicago, Illinois.

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CHAPTER I

INTRODUCTION

The peculiar characteristics and the therapeutic value of short wave diathermy are best appreciated against the background of what is now commonly called "conventional" or "long wave" diathermy. Those who are familiar with the history of this older form of diathermy know that it marked an epochal advance in thermotherapy. It proved, in its time, to be the best known method of treatment by heat, that is, for creating heat within tissues, including deeply situated regions and viscera — heat being created within the tissues, not carried to them from without. Difficulties encountered were due to the fact that the heating was not uniform, since the current would not readily penetrate high resistance tissue; surface heating was more pronounced; finally, close contact electrodes were essential for therapy, and this application required constant care to obviate burns.

Short wave diathermy, in contrast to conventional diathermy, has the advantage of more uniformly heating the protected and isolated tissue: insulated electrodes are used, which do not require intimate contact; the danger of burns is reduced to the minimum and can be obviated by proper technic. In brief, short wave diathermy is a distinct advance, with few exceptions affording everything attainable by conventional diathermy and permitting applications wholly impossible with that older method. The following chapters will make these points clear.

Historical Considerations. — The cradle of short wave diathermy is America and credit for its discovery goes to Schereschewsky, who was the first to note that animals exposed to short

wave "electric fields" succumbed. It was also noted that workers engaged in the immediate vicinity of high power wireless transmission apparatus manifested a sense of heat, some individuals even complaining of headache and malaise, which abated only after leaving their work. These observations led to studies concerning the peculiarities of short wave currents. Finally, Esau, Schliephake, and other pioneers undertook actual clinical investigations. Today our present knowledge of and experience with short waves has revolutionized electrothermotherapy. Short waves have proved applicable and useful in types of infections for which conventional diathermy is regarded as contraindicated, also they affect tissues in a manner unattainable by any other known method of treatment. Historically, of course, honor is due also to such early investigators and scientists as d'Arsonval, Heinrich Hertz and those whose experiments and observations with electric currents of different types did much to pave the way for the advent of both conventional and short wave diathermy.

Something should be said regarding the term "short-wave diathermy." This designation has been recommended by the Council on Physical Therapy of the American Medical Association. Other terms — "radiathermy," "radiothermy," and various trade names — have been suggested. The important point to consider is that short wave diathermy differs from conventional diathermy. With conventional diathermy, the current passes directly to the part under treatment through electrodes in direct contact with the body. With short wave diathermy, electrode contact with the body is not necessary, obviating a direct flow of conductive current from the electrode to the part being treated. Treatment consists of bringing the body or part, not into intimate contact with electrodes but into a so-called field between highly insulated electrodes. How this field is produced and the various technics of application will be described later. The term "ultra short" is sometimes applied to wave lengths less than 10 meters.

Wave Length or Frequency. — In short wave diathermy, it is customary to speak of wave length rather than frequency. This is for greater convenience and easier visualization and is permissible since a definite number of alternations (oscillations) always corresponds to a definite wave length, as will be seen in the illustrations given below. By wave length, is meant precisely what the term implies in ordinary English. It is known that all electromagnetic oscillations, such as light, for example, have a speed in space of 300 million meters per second. By simple division of this number with any desired frequency, we obtain the wave length in meters. Thus, if we know that a short wave apparatus has 50 million oscillations (double alternations) per second, or, as it may be expressed, 50 million cycles, we use this simple formula:

$$\frac{\text{Speed of oscillations:}}{\text{Frequency:}} \quad \frac{300{,}000{,}000}{50{,}000{,}000} = 6 \text{ meter wave length.}$$

By the same simple division, we arrive at the number of alternations or oscillations when we know the wave length of any apparatus. Taking an apparatus of 12 meter wave length, we obtain:

$$\frac{\text{Speed of oscillations:}}{\text{Wave length in meters:}} \quad \frac{300{,}000{,}000}{12} = 25{,}000{,}000 \text{ frequency.}$$

In other words, the higher the frequency the shorter the wave length and vice versa, the longer the wave length, the lower the frequency. (Fig. 1.)

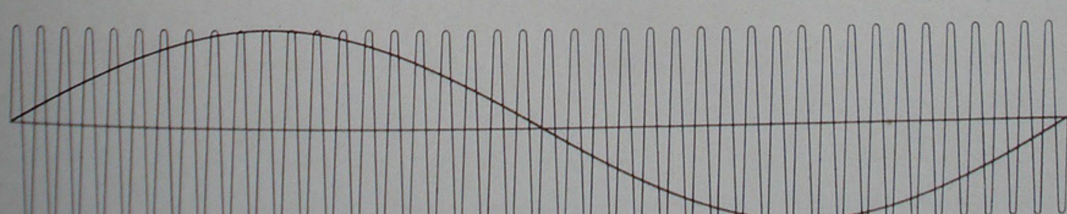


Fig. 1. Short wave tubes produce undamped or continuous oscillations. (Long wave diathermy oscillations are damped.)

Effects of Short Waves. — The literature on the physiologic properties and therapeutic effects of short wave diathermy has already assumed considerable dimensions. The following points include the most important authoritative observations so far made.

The Council on Physical Therapy of the American Medical Association state: "The effects of an electric current when applied to the body tissues may be thermal, chemical or mechanical in nature, depending on the physical characteristics of the current. High frequency currents apparently avoid the mechanical and chemical effects but have the ability to heat the body tissues through which they pass. At the present time it is believed that the local physiologic effects of the three methods of applying high frequency currents are limited to the effects of the heat produced."

It has been proven that short wave diathermy is by far the most effective method of producing heat in the depths of human tissues. The far reaching therapeutic effects of short wave diathermy can be realized by a review of some of the effects of this deep heat.

1. With moderate heat the number of open capillaries is increased.
2. The rate of flow through the capillaries is increased.
3. Tissue metabolism is accelerated.
4. The rate of exchange of O and CO2 between the blood and tissues is increased and reaches its optimum.
5. Relaxation of tissues is induced especially of the muscles probably due to the dilatation of the blood vessels and a greater total blood flow in the area concerned.
6. Phagocytosis is greatly modified. The activity of the leucocytes in phagocytosis is increased.
7. There is also a local increase in the number of leucocytes in the part heated.

8. There is an influence on the sympathetic nervous system shown by a reflex vasodilatation to the heat at a distance from the area treated.

9. There is an increased rate of transfer of fluid across the capillary wall during the vasodilatation induced by heat.

The foregoing nine "theses" convey indirectly a hint to the large number of therapeutic indications for short wave diathermy. These will be analyzed in detail under their respective groupings. It is deemed practical, first, briefly to discuss the therapeutic technics of short wave diathermy and, following, to point out certain differences from those of conventional diathermy.

CHAPTER II

GENERAL FACTS REGARDING SHORT WAVE TECHNICS

With short wave diathermy, there are several methods of application, based on differences in electrodes — the most important being (1) the inductance cable for electromagnetic induction, (2) cuff condenser electrodes, (3) pad condenser electrodes, and (4) air-spaced condenser electrodes. Insulated orificial electrodes are also used, but it is generally considered better technic to heat an entire area than to use this type of localizing electrode, inasmuch as surrounding tissues or organs might also be affected and thus benefit from the more widespread heating. Glass or bakelite insulation is sometimes used in electrodes to replace rubber composition.

A patient to be treated is generally placed on a table or bed or seated in a chair. Conductive materials must be avoided. Generally, local treatments (extremity or body part) may be arranged as is most convenient. Systemic treatments, on the other hand, usually referred to as therapeutic fever (hyperpyrexia), require a much more complicated set-up, they take more time and provision must be made not only for raising the patient's temperature but also cooling off the patient after the treatment. The details of fever treatment will be given later.

The Inductance Cable. — This cable is in effect a single, flexible and insulated electrode, which is wound around a limb or part of it, or around the torso, head, or other part, one, two or more turns, or it may be coiled in pancake style and placed against the shoulder, hip or other region of the body. Wooden separators keep the coil in place without cable surfaces touching.

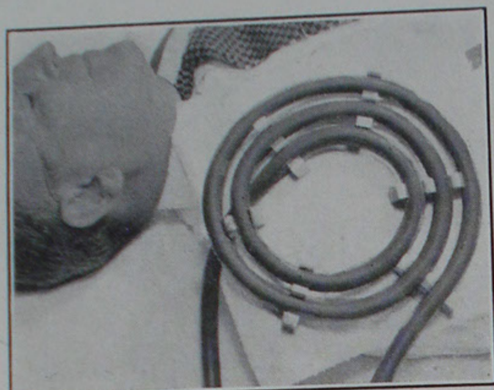


Fig. 2. Cable application to shoulder. Note separator blocks separating coils to increase depth of heating.

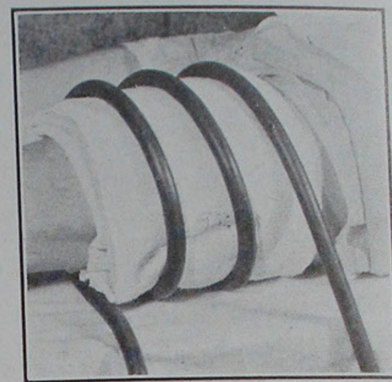


Fig. 3. Heating of limb by inductance cable. Several folds of towelling under cable.

The illustrations show the different types of application (Figs. 2 and 3).

Cuff Condenser Electrodes. — Cuff electrodes function well on all wave lengths. They effect results very much like or equal to those of the inductance cable. Application is made by fastening the cuffs around an arm or leg (Figure 4), or around the torso for fever production. Cuff electrodes must be separated some distance as shown in the illustration. The construction of these electrodes is simple — a flexible metal part, covered with proper insulation is attached to a cord for connection with the short wave apparatus. Cuff electrodes are always used in pairs. Generally, they should be secured snugly in place.

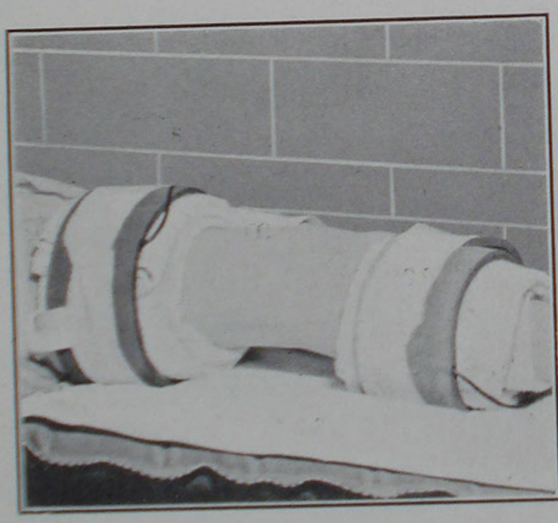


Fig. 4. Cuffs to heat knee joint. Spacing between cuffs important.

Pad Condenser Electrodes. — Pad electrodes differ from cuff electrodes only in size and shape. They are small and cannot be

wrapped around the part (see Figure 5). Pad electrodes are also used in pairs. They are not as effective for deep heating as cuffs or the inductance cable. Generally their use is preferred for localized applications. When pad electrodes are used, they are generally placed on as nearly opposite sides of the part to be treated as possible. One or more active pad electrodes may be used simultaneously with a large indifferent electrode, the former requiring a multiple binding post.

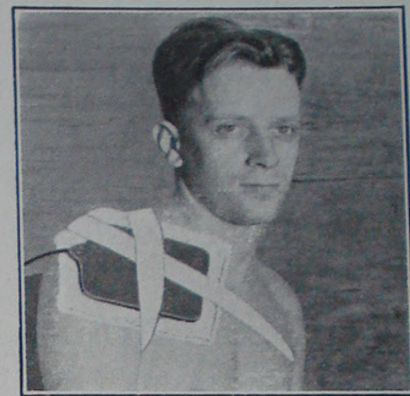


Fig. 5. Pad condenser electrodes to heat shoulder. Indifferent electrode at back.

Air-Spaced Condenser Electrodes. — These are available in four sizes — 1½″, 3″, 5″, 7″ circular metal plates, designed within insulating material. Adjustable arms, fastened to the apparatus, permit applications in any required position. Insulated cables connect electrodes to regular outlets. Applications of air-spaced condenser electrodes are similar to those made by other types of condenser electrodes and are especially valuable for local but not for general heating. These electrodes are especially efficient for treatments of the head. They are generally used in pairs, sometimes a single active one is used with a large indifferent (pad) electrode, when it is desired to concentrate heat. With this type of electrode, towelling or similar material is unnecessary, as current energy leakage is greatly lessened (Figure 6).

Fig. 6. Air-spaced electrodes applied to antra.

As regards dosage, the only reliable guide is the sense of warmth experienced by the patient. It must

never become unpleasant, patients being instructed to notify the physician or technician at once of any excess of heat. Usually a local treatment of 20 minutes suffices and since most patients show a mild systemic heating in addition to the local warmth, they should not leave the office until they have cooled off.

General Rules. — Without here entering into a discussion of the reasons and details of the various technics of application, which will be given later in connection with individual affections and diseases, the following are essentially the principal general directions which should be followed:

1. Before giving the first treatment, care should be taken to ascertain that the patient has normal sensitivity to heat and cold. This is easily accomplished by placing two test tubes, one filled with hot and the other with cold water, to the skin of the patient with the direction to indicate which is hot and which cold.

2. Patients must be instructed that short wave diathermy should produce only pleasant warmth and that any unpleasant heat sensation should be reported at once, so that the current can be reduced in intensity. It goes without saying that with patients suffering from a disease characterized by reduction or total absence of sensitivity to heat, the utmost care should be used to make sure that only moderately intense current is administered. This may be easily determined by the physician placing a hand from time to time under the electrodes.

3. When patients do not disrobe, although that is to be recommended generally to avoid messy treatments, they should be instructed to remove metallic objects from the area of treatment (money, pocket knife, keys, watch and the like).

4. Chairs and tables used for treatment should be free from metal parts.

5. When treating a region in which a bony part projects outward, the current must be stopped immediately when patients

complain of a painful sensation instead of the anticipated pleasant warmth. This painful sensation may be due to overheating of the periosteum. Additional padding (towelling) at the point will greatly modify this difficulty. The treatment may be resumed at moderate dosage when the patient reports that the painful sensation has disappeared.

6. For the padding of electrodes, no other material need be utilized than ordinary Turkish towelling (Terry cloth). Certain other substances such as art leather, oil cloth, old rubber mats and the like may actually prove semi-conductors, become overheated and thereby nullify the effect of the treatment. Felt is not recommended for padding because it cannot readily be cleaned.

7. Deep heating effects are best obtained by applying the electrodes at a distance from the surface of the body. This spacing ranges from one 2/5 to 2cm five centimeters. The larger the electrode, the greater should be the distance from the skin.

Fig. 7. Technic (after Duval) for heating prostatic area. Patient seated on pad electrode, cuff electrode around waist. Removal of clothing recommended.

8. In hot weather and with patients prone to perspire, care should be taken not to allow the towelling to become too moist.

9. It is good practice to select electrodes larger than the region to be treated in order to stimulate the lymph current and the blood stream of the neighboring normal region.

10. Concentration of the

current, especially for the treatment of infectious processes or other conditions requiring a more powerful application of the current, is accomplished by placing the active (smaller) electrode somewhat nearer to the lesion (Fig. 7).

11. Careful watch for untoward reactions should be kept when treating the head, as occasionally patients complain of headaches and dizziness, in which case it is best to stop the application, give appropriate treatment (reclining posture, cold compresses) and resume the short wave treatment after the symptoms have abated, but with a less intense current.

12. Patients suffering from heart disease require considerable watching. The intensity of the current must be reduced if the pulse becomes greatly accelerated.

13. Patients should not be permitted to regulate the current, no matter how intelligent they may be. This implies that either the physician or a qualified assistant must remain with or near the patient, so as to be on hand to regulate the current whenever it becomes necessary.

CHAPTER III

THE QUESTION OF WAVE LENGTHS

The question whether different wave lengths (within the range between 2 and 24 meters) yield different effects, has engaged the attention of many investigators. Numerous ingenious experiments have been undertaken to obtain an answer and while theoretically many of the experiments indicated specific or at least selective effects for various wave lengths, these have not been accepted as conclusive in a clinical sense.

Obviously, it is one thing to study the effects of various wave lengths on a glass jar containing normal saline solution, pieces of meat, or colloidal solutions, and quite another to study the effects on inflamed parts of the body. The conditions in the body are necessarily different, for apart from the question of pathogenic micro-organisms one has also to consider the ability of the circulation to dissipate heat and to carry off effete material. Even animal experiments cannot fully replace actual clinical experience.

One cannot ignore, however, certain theses that have been advanced. The most important one is that the shorter the wave length, the greater are the heat and depth effects. If such a conclusion were true, then a 3-meter short wave apparatus should prove the most effective therapeutically. Indeed, one might even go farther and assume that an apparatus providing waves of one meter, or perhaps even less would be still more effective. As a matter of concrete experience, apparatus of even a 3-meter wave length has proved utterly inadequate in the hands of qualified observers, for the simple reason that the loss of energy is so great as to offer a patient's circuit too weak in capacity to have a worth while effect on tissues.

Here and abroad, accordingly, the minimum wave length that has been widely used is that of 6-meters, while other equally competent clinicians make general use of the 12-meter or even somewhat higher wave length (18, 24 meters). As all points concerning the value of wave lengths have not yet been fully determined, preference must depend on the results of personal observations in actual medical practice. These justify the formulation of the following statement which may be accepted as a guide:

> The difference between a 6- and 12-meter wave length is therapeutically of no great importance. The 6-meter wave length is perhaps more suitable for local treatments (small areas) owing to its more uniform penetrative power.
>
> The 12-meter wave length is more suitable when more general (systemic) effects are desired. It is also highly effective for local treatments. The difference in effects is slight in any event and remains so, even when wave lengths up to 24 meters are used.

The preference that might be given one wave length over another is still more limited by the circumstance that deeper heating effects from a good apparatus, no matter of which wave length, can be obtained by proper air-spacing of condenser electrodes, as will be shown. The following suggestion, however, may not be without value. A physician who contemplates treating only purely local conditions, as around the head, might do well to select a 6-meter apparatus. A practitioner who plans more general use for his apparatus, and who has facilities also for "fever therapy," should prefer the 12-meter (or longer) wave length apparatus. It must also not be overlooked that the systemic heating now used for cerebral syphilis, gonorrhea and other infections should be a hospital procedure. Even where milder

systemic heating is used outside of the hospital, one should have at least a qualified technician or nurse, because patients must be under constant observation while under treatment.

Those who desire to make careful and extensive use of short wave diathermy for scientific observation can secure equipment which permits them to utilize several wave lengths.

CHAPTER IV

GENERAL INDICATIONS AND CONTRAINDICATIONS

The physiologic effects of short wave diathermy, presented in previous pages, convey an idea of its therapeutic indications. At the same time, it is important to realize that while the principal effect of short wave diathermy is thermic in character, it is not to be regarded as merely an improved type of diathermy. Short wave medical diathermy is the most effective method of producing deep heat. Its value was compared with other methods in an article authorized by the Council on Physical Therapy. It was shown that a hot water bottle produced a rise of temperature in the human thigh after a 20 minute application of less than one-half degree F., the heat maintained to the patient's tolerance. Conventional diathermy after 20 minutes given to patient's tolerance at the same depth in the quadriceps extensor muscle produced a rise of about 2.25 F. Short wave diathermy under the same conditions in the same muscle at the same depth produced a rise of 4.75 F.

1. **Artificial Hyperemia.** — While every form of heat applied to the animal body produces hyperemia, short wave diathermy possesses this characteristic to a degree and in a manner unattainable with any other type of thermotherapy, including conventional diathermy. With the latter, which not so long since was regarded as the last word in the medical use of the high frequency current, it takes some time until sufficient warmth is developed in the tissues to produce local hyperemia. In short wave diathermy, hyperemia is produced much more rapidly. This hyperemia appears in structures (bones and

highly resistant tissues) that are beyond the reach of conventional diathermy. Furthermore, the hyperemia lasts much longer, so that the sensation-effect of a treatment may extend for hours.

2. **Analgesia.** — Short wave diathermy produces striking relief from pain in many cases involving not only inflammatory processes but conditions commonly regarded as neuralgic in nature. Conventional diathermy, too, has such an effect, but not as promptly nor as lastingly as has been observed in numerous instances with short wave diathermy. Nearly every physician, who has gained clinical experience with this modality, has seen patients who after treatment were enabled to get a good night's sleep without drugs when every other attempt had failed to stop intense pain due to a variety of causes. Often one short wave treatment suffices to obtain such a desirable effect, but usually a few additional treatments are needed before the patients gratefully acknowledge relief.

Bactericidal Effect. — From the physiologic effects, it is seen that the activity of the leucocytes in phagocytosis is increased by heat. There is also a local increase in the number of the leucocytes in the part heated as can be seen from the leucocytes sticking on the vessel walls. These facts would tend to confirm the value of short wave medical diathermy in suppurative processes, and observers state that the course is usually very much shortened in a variety of infective processes, especially furuncles, carbuncles, felons, and the like. At the same time, it cannot be emphasized too strongly that success rests on proper dosage, for overdosage may have the very opposite effect, namely, suppression of the defensive forces of the body.

Short wave diathermy is contraindicated (1) over areas where there is a tendency to hemorrhage, such as a bleeding gastric ulcer, over the chest after a recent hemoptysis, over the abdomen

in pregnancy; (2) over areas where there is an absence of skin sensation, such as in certain peripheral nerve injuries.

Comparison with Conventional Diathermy. — The impression that the advent of short wave diathermy has rendered conventional diathermy obsolete is erroneous. The indications for the therapeutic use of conventional diathermy still are those that have been established during the years it has been employed by many physicians as a recognized agent. This in general holds good for more or less chronic inflammatory processes and conditions of a painful nature involving external and superficial structures. Accordingly, short wave diathermy should not be regarded as an agent that has replaced conventional diathermy, but rather as one which has a wider range of applicability, including many types of inflammatory processes in the acute and sub-acute stages.

Surgical Uses of Short Wave Diathermy. — A good short wave apparatus should be equipped to permit electrodissection and electrocoagulation of tissues. The short wave apparatus so equipped does not, however, replace the older spark gap apparatus of longer wave lengths with which countless successful electrosurgical operations have been performed. The much higher frequencies of short wave diathermy appear to be superior for electrodissection while, on the other hand, the older type of electrosurgical apparatus is perhaps more suitable for massive electrocoagulation.

As this book is primarily devoted to a consideration of **medical** short wave diathermy, we cannot here enter into a discussion of operative technics. Suffice it to say that one must first familiarize one's self with the outlets to be utilized, after which a few trials on raw meat will show whatever slight variation there is in comparison with the surgical effectiveness of the older apparatus.

CHAPTER V

TECHNICAL CONSIDERATIONS

In various quarters, there have been attempts to convey the impression that the therapeutic technic of short wave diathermy is simplicity itself. It is true that no especial manual dexterity is involved. Yet the selection of the proper procedure is by no means a mere matter of routine. The intelligent use of short wave diathermy presupposes familiarity with the characteristics of the condenser and electro-magnetic fields, the nature of electrodes, and dosage.

The indications for short wave are primarily those conditions in which heat for one reason or another is essential. The effects of heat, from the viewpoint of increasing the circulation in a given part and affecting the chemical changes that go on in the body, including the resulting benefits that are derived from these effects, are of tremendous value and closely approximate nature's own method of combating disease. The opinion of the best authorities is that where heat is indicated there is some relation between the value of the application and the rise in temperature of the part desired, insofar as the application is kept within the patient's tolerance — perhaps within the temperature of about 104 to 104.2° F., at which the blood supply appears to reach its maximum.

Heat generation from short wave currents begins gradually and accumulates. It takes a moment or so before the patient begins to feel what might be called comfortable warmth and that is precisely what is needed for reconstructive treatment. Too much current develops heat too fast and the skin may get too

hot resulting in hot spots, blisters, burns, and a dull ache. Never disregard a patient's complaint of "too hot."

Undoubtedly a great deal of the confusion about the effect of the application of short waves has been occasioned by a lack of understanding of the electrical principles involved. We must consider that it is the heat generated in the body by the current that is of value. Short waves unquestionably heat up insulated or isolated conductive portions of the body to a greater extent than does conventional diathermy and consequently affords a more even distribution of heat.

A further consideration in the application of short waves is that the portion of the body immediately near the surface and underneath the electrode receives the greatest density of the current, thereby causing a tendency to heat up this portion somewhat excessively. So many nerve endings being located near the surface give the patient a decided sensation of heat, even though the depths of that part might be actually raised very slightly in temperature.

In considering the application of short wave diathermy with pads, therefore, wherein the area of entry of current into the body is less than the cross section of the part to be heated, it is reasonable to assume that the current is at its greatest density in that portion immediately near the surface of the skin, and the heat generated there is greater, thus giving the patient a pronounced sensation of heat. As the current leaves the area immediately underneath the pad, it spreads out more or less in all directions, seeking the path of least resistance. As the current density in a particularly conductive area rises, it causes the current to seek out the somewhat less conductive areas. This gives us a very rapidly decreasing current density as the current spreads from the area immediately underneath the electrode, which we may term the area of entry into the body.

The current density decreases depending upon the size of

the electrode as compared to the possible area through which the current may pass. It is a well known electrical law that the heat generated by a current decreases as the square of the density of the current per cubic centimeter. In other words, if the current is going to decrease very rapidly in density as it leaves the area of entry into the body and the temperature generated decreases as the square of the density per cubic centimeter, then it is very apparent that the amount of temperature rise generated to any depth with pad electrodes, less in size than the cross section of the part we are to treat, is practically nil, considering circulation and other effects.

When "cuff" electrodes are used where the area of the cuff electrode is considerably larger than the cross section of the part being treated, a very substantial rise in temperature is produced deep in the tissues. In fact, by having the cuffs sufficiently large and sufficiently far apart, any area may be heated to almost any desired temperature within physiologic limits. The point is that cuff electrodes must be considerably larger than the cross section of the part being treated, thereby allowing the current to enter the patient's body at as low a density as possible, in order to remain well below tolerance at that point; then have cuff electrodes as far apart as is convenient (the farther apart the more heat generated).

Owing to the fact that where electrodes are of small area, thereby causing the port of entry of the current to be smaller in area than the cross section of the part to be heated, and consequently giving a high surface temperature with very little heat in the depth, there is practically no relationship between the patient's sensation of heat and the actual rise in temperature in the part being treated. With small pad electrodes, the patient can be given a tremendous sensation of heat with practically no rise of temperature in the depth of the part being treated, whereas by using cuff electrodes, giving a large area through

which to have the current enter the patient's body, the heating will stay well within the comfortable tolerance of the patient and yet there will be a very substantial rise in temperature deep in the parts being treated.

An interesting experiment is to use small pad electrodes, front and back of the pelvis, give the patient all the current that can be tolerated for, say, 20 minutes, and see how much actual rise in temperature occurs in the rectum or the vagina. Conduct the same experiment but place large cuff electrodes, size 9″x48″ around the patient's abdomen and a large cuff electrode, size 12″x40″ around both thighs. Give the maximum amount of current that can be tolerated for the same period of time and you will note that the large cuff electrodes produce a far greater rise in temperature. On any and all parts that are susceptible to treatment with cuffs, one can get with them a much greater rise in actual temperature. It is our recommendation that, when deep heating is desired, cuffs or the inductance cable be used whenever possible. The inductance cable produces deep heating effects quite similar to those of cuff electrodes.

Connecting cords of electrodes should be kept well separated and at rest while treating. Tangled cords give a false current reading and swinging cords cause a fluctuation and variation of heat production. Connecting cords should not come in contact with the patient or with any material that would conduct currents from cord to cord or from cord to conductive materials instead of through the patient.

It is essential always to bear in mind that the current density is greatest at the electrodes proper. This clearly shows the reason why direct contact of the electrodes with the skin should be avoided.

The following series of illustrations (Figs. 8 to 15) is presented to show the heating effects produced by short wave diatherapy. Agar-agar in a petri dish was used as a medium. The

letters — A, B, C, D, E, F, G, H, I — represent actual thermometer tests, A being maximum, B, ten per cent less than A, C ten per cent less than B and so on through the series. It is evident, of course, that agar-agar is not human tissue. Some such graduation of heating, however, does occur in human tissues. The white lines in the circles are not to be taken as sharp limits of temperatures. Obviously the blending is gradual.

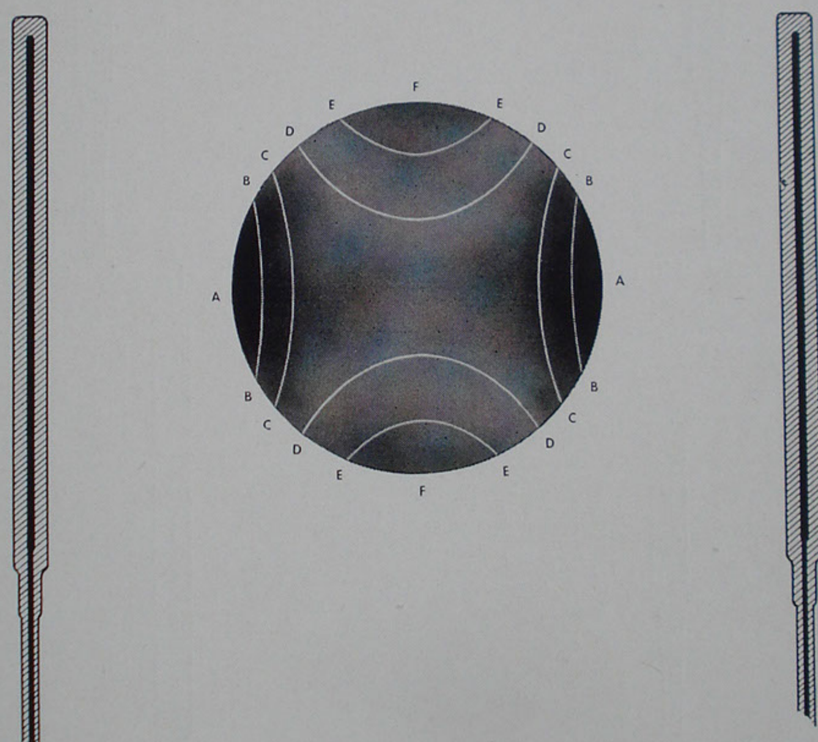


Fig. 8. Effect with electrodes larger than part and equidistant. Heat fairly uniformly distributed through part.

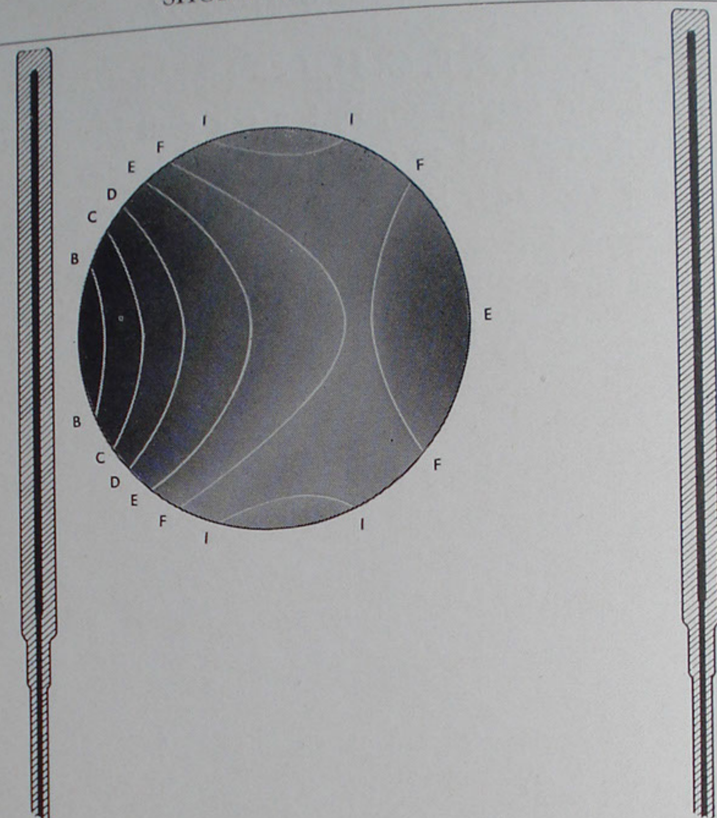


Fig. 9. Effect with electrodes larger than part and one electrode closer. Heat concentrates toward closer electrode.

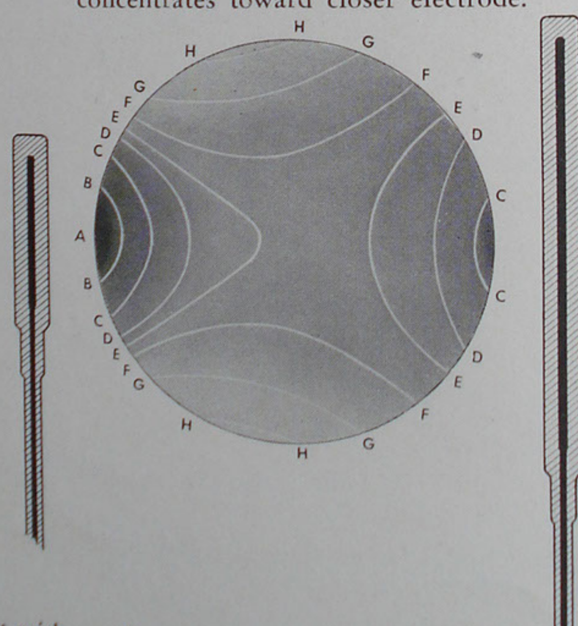


Fig. 10. Effect with small and large electrodes, equidistant from part. Heat concentrates toward smaller electrode.

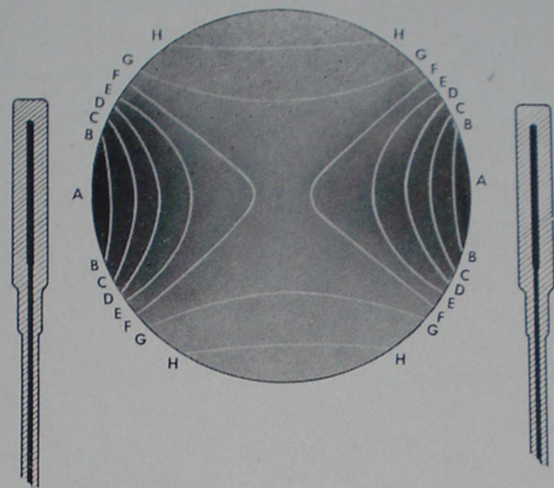


Fig. 11. Effect with electrodes smaller than part and equidistant. Heat fairly uniformly distributed under electrodes.

By keeping the electrodes at a slight distance from the surface of the body(effected by the electrode insulation, also towelling) not only are burns avoided but also overheating of the superficial strata at the expense of the deeper structures. Since in short wave diathermy the principal therapeutic aim sought in most cases is heating in depth, this is attainable best by proper selection of electrodes and proper spacing between the surfaces of the electrodes and that of the human body. The series of drawings presented in this chapter illustrate these points.

Figure 8 shows diagrammatically what may be termed the normal treatment in accordance with the above discussion. It should be noted that the two electrodes or, if you will, the condenser plates are not only of equal size but approximately equidistant from the skin of the part treated (say a knee or elbow). It is also of interest to note that the electrodes are larger than the cross section of the part. Here it will suffice to point out that, as the illustration shows, the field density is most pronounced in the center and axial lines, so that there the part is being heated most intensely.

Figure 9 shows a modification in condenser technic, in which

one electrode is placed nearer the skin than the other. Naturally the electrode nearer the skin has a narrower field of entrance, greater field density, and through it also a more superficial heating effect. What takes place if in the above case the closer electrode is also smaller than the other one, is illustrated in Figure 10. If this modification of technic were carried to its ultimate extent, that is, with the active electrode being reduced in size to a pinhead and brought into intimate contact with the skin, one would obtain the effect known as electrocoagulation.

So far we have discussed condenser effects when the electrodes are larger than the cross section of the object treated. The effect of electrodes smaller in size than the region subject to treatment is shown in Figure 11. Compared with what we have ac-

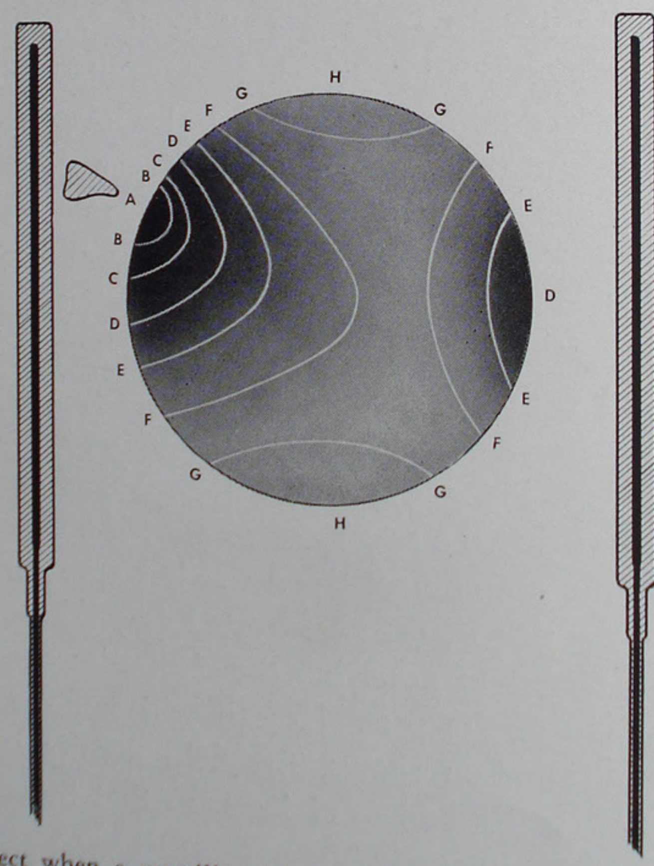


Fig. 12. Effect when a metallic object (watch, keys) is within condenser field. Note concentration of heat toward metallic object at A.

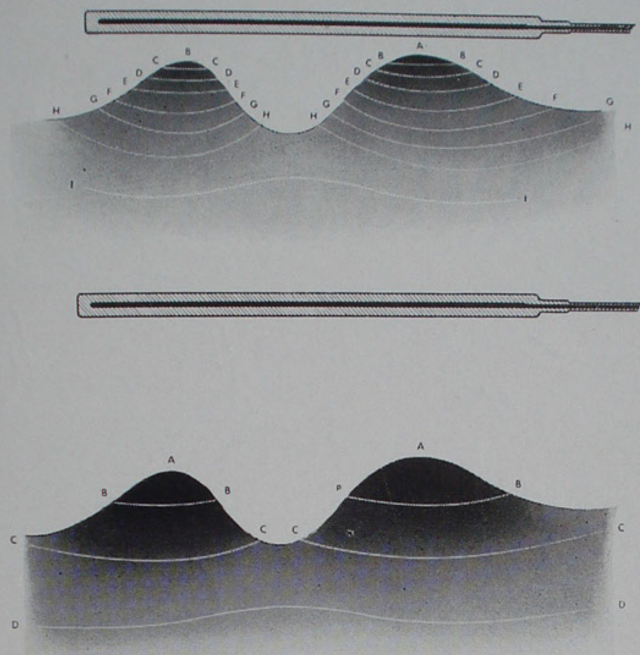


Fig. 13. Effect when electrode is close to irregular surface, also when electrode is moved farther away (by towelling). When electrode is too close, heat concentrates in mounds, and might produce burns.

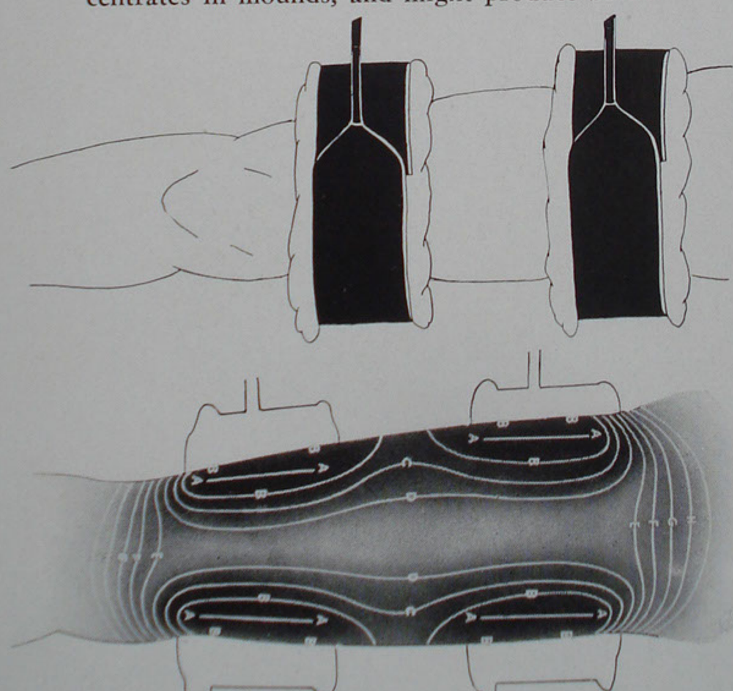


Fig. 14. Effect with cuff application — method of application indicated. Heat is spread fairly uniformly throughout part, carried outward by blood stream.

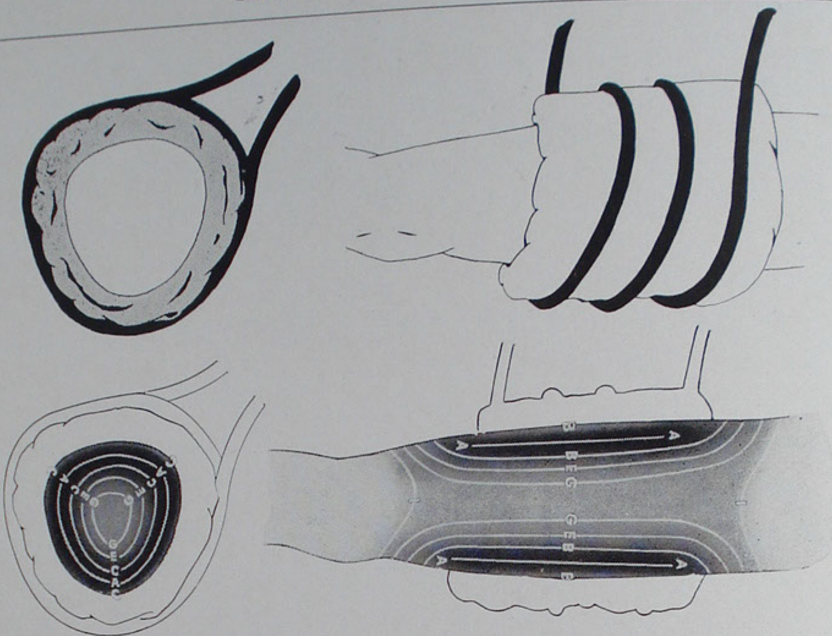


Fig. 15. Effect with cable application — method of application indicated. Heat distributed fairly evenly throughout part, carried outward by blood stream.

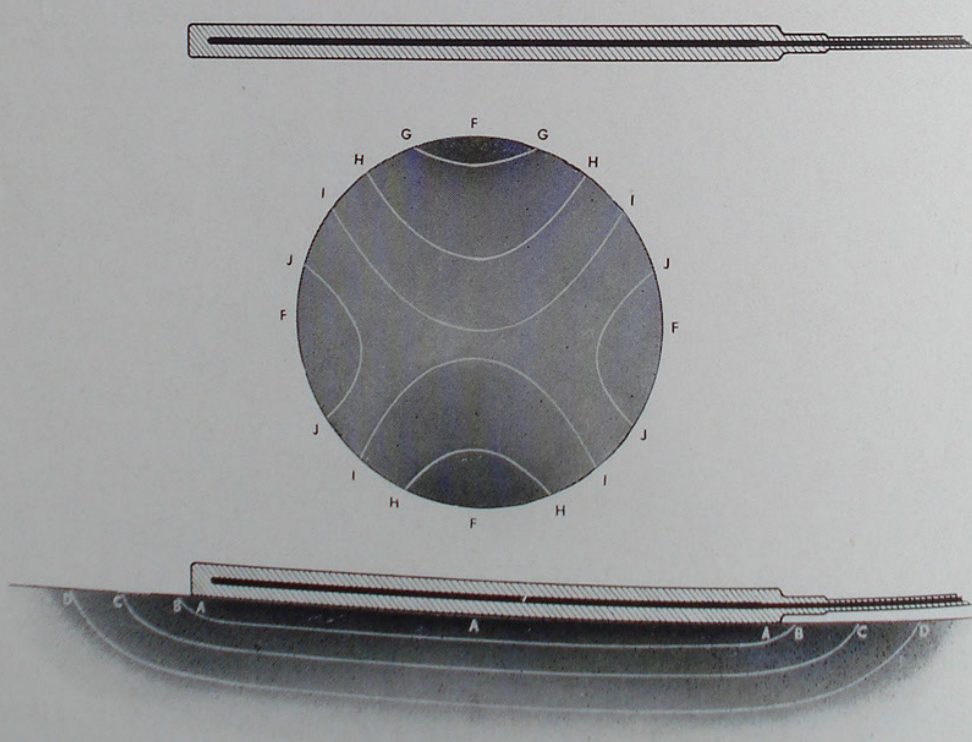


Fig. 16. Effect when conductor — such as metal table, bed, spring, wet blanket and so on — is too near electrode. Energy passes to conductor resulting in loss, less heating of part and danger of burning out tubes.

cepted as a normal treatment (Fig. 8), we observe greater dispersion of the field density, with the superficial parts appearing to be flooded through much more than the deeper strata in the axial lines. This superficial effect proves desirable for the treatment of superficial infections and lesions.

Two condenser electrodes placed alongside but apart from each other, such as to the posterior thigh above the knee and to the calf above the ankle, would produce only superficial heating. It is readily seen that with such a technic one could produce an effect only on the muscles and peripheral nerves running from one electrode to the other.

Figure 12 clearly shows what takes place when a metallic object happens to be in the field. We note that the field lines become very dense at the object and are apt to cause a burn. This explains why all metallic foreign objects, such as pocket pieces, belt buckles, garters with snaps, finger rings and the like should be removed before treatment. The remaining drawings in the series are self-explanatory.

There are additional technical details, whose special applicability to definite diseases or conditions merit consideration and are here presented.

Fig. 17. Condenser cuff, pad, insulated orificial electrodes. Available in assorted sizes.

Electrodes. — Since we have already mentioned electrodes for short wave diathermy, we may here restrict ourselves to a few special remarks. Irrespective whether one makes use of pliable plate, cuff or coil electrodes, or of more or less rigid disc-like applicators, all that has been said about condenser effects applies more or less to all types except possibly those utilized as orificial applicators of the non-insulated type, such as are used with conventional diathermy. Even in the last named group foreign workers took the precaution to interpose some suitable dielectric between the applicating surface of the electrode and the organ (prostate, uterus, cervix) to be subjected to short wave diathermy. In America, it was found that this type of orificial electrodes properly insulated prove more effective and less likely to cause burns when used with short wave diathermy. No matter whether we make use of cuffs, pads, coils, or air-spaced electrodes (Figs. 17 and 18) the principles of current capacity, dispersion and density of the field lines follow those outlined above.

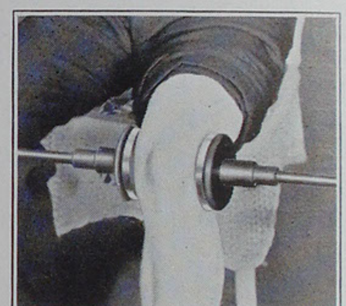


Fig. 18. Air-spaced electrode application to knee.

Dosage. — It is one of the peculiarities of short wave diathermy that we have no precise means of knowing that amount and intensity of the current flooding a part or the entire human body. While in conventional diathermy the ammeter is a relative indicator of milliamperage, in short wave diathermy the meter indicates that point at which duplications can be obtained, when conditions are identical. It is also the source of indication of increase or decrease of dosage.

In the last analysis, this peculiarity should not prejudice anyone against short wave diathermy, for, if anything, many will feel that the less we rely on machinery and the more on our own

senses and judgment, the better will be the therapeutic results. There is no better indicator for the proper dosage than the patient's sensation. Given one whose sensibility is not impaired (otherwise special care must be exercised), the patient need but be instructed that a sense of pleasant warmth is the right dose, that anything above or below is either harmful or useless. Accordingly, the best control is to make frequent inquiry and to increase or decrease the current, according to whether the patient claims to feel little or nothing or complains of feeling "too hot." This leaves only the question of time. Here, too, no fixed rules can be laid down. One may accept about 20 minutes for local treatment, and 5 to 15 hours for "artificial fever."

Personal experience interpreted along physiologic lines will prove a better guide to a given case than general rules.

CHAPTER VI

TREATMENT SUGGESTIONS

The following suggestions cover the physical application of different electrodes to different body parts and for different purposes.

Limbs. — A Turkish towel or Terry cloth is folded (several layers) and wrapped around the limb, below and above the area to be heated; a cuff type electrode of sufficient length to completely encircle the limb is then placed over this towelling and bound in place. It is not always possible to select an electrode of just such length that will make a complete circle around the limb but overlapping will do no harm — or should the electrode be a trifle short of a complete circle there will be very little difference in the heating effect. Simply select the electrode most adaptable (Fig. 19). Care must be taken to keep the limb extended, that is, not flexed.

Fig. 19. Cuffs arranged to heat elbow. Cuffs wrapped entirely around arm. Note distance of separation.

Another method is to place an active electrode $5\frac{1}{2}'' \times 8\frac{1}{2}''$ (with some towelling between) on the sole of the foot (Fig. 20). If the patient is sitting, the foot is merely placed on the electrode — if reclining, the pad must be bound in place. A large indifferent pad electrode is placed at the patient's back. If patient

is reclining, it is best to place this electrode on the abdomen with a folded Turkish towel under it, securely binding it in place.

When employing the inductance cable, place several layers of Turkish towelling about that section to be heated, and over the

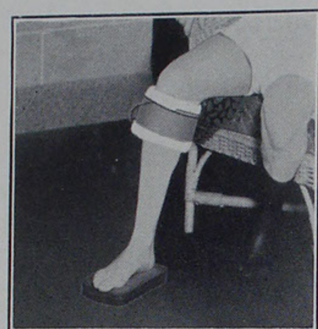


Fig. 20. Cuff and pad arrangement for heating foot and ankle. (The foot electrode should not be placed on any conductor.)

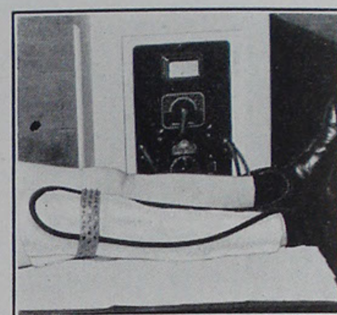


Fig. 21. Cable application, single loop of cable from knee to ankle. Held in place by bandage.

towelling from two to four turns of the cable. Such applications are more or less a matter of experiment and without such experimentation it will be impossible for any operator to ascertain the full value of short wave applications (Fig. 21).

Shoulder. — Wrap a towel around the arm above the elbow, and around it a cuff electrode of sufficient length to make a circle. The other (medium sized plate) electrode is placed over a folded towel on the top of the shoulder, well over toward the neck. To heat

Fig. 22. Arrangement for heating shoulders. Cuff electrodes on each arm.

both upper arms and shoulders place cuffs (over towels) around both upper arms (Fig. 22).

Or a large plate or pad electrode is placed under the patient's back (with towelling between) and several inches of insulating padding is placed on the abdomen. Upon this place a 5½"x8½" pad electrode. The patient places both hands on this pad and maintains contact with the palms. A towel between the hands and this electrode, and wrapped about the hands and arms helps to confine the heat.

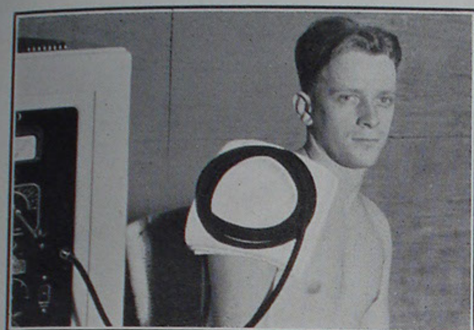


Fig. 23. Use of cable to heat shoulder. (See Fig. 2 for use of separator blocks.)

When employing the inductance cable for treating the shoulder, place several layers of Turkish towelling over the shoulder. Then either drape two to four turns of cable around the shoulder, as illustrated, or place these turns of cable on wooden treatment table, covering them with several layers of Turkish towelling, and have patient recline with the shoulder over the coil (Fig. 23). An air-spaced application is shown in (Fig. 24).

Fig. 24. Air-spaced electrodes arranged for heating shoulder.

Bronchi (upper lung area). — When the inductance cable is to be used in treating the lung area, the patient may be placed on a wooden treatment table (patient on back) and a coil of from two to four turns of the cable placed over the part of the chest to be heated (first placing over the part sev-

eral thicknesses of Turkish towelling). One full turn of the inductance cable (actually 1¾ coil turns) will suffice.

Place 5½"x8½" condenser pad electrode parallel to the sternum with some towelling between it and the patient. Bind on securely. Have patient sit with back against (or lie upon) a large indifferent electrode (Fig. 25).

Fig. 25. Use of pad electrodes in pneumonia. Indifferent electrode under patient.

Gall Bladder. — Place 5½"x8½" condenser pad electrodes upon right side of abdomen on a line with the lower rib and extending from navel to the right — have towels between it and patient. Bind this electrode snugly in place. Place larger electrode on patient's back (Fig. 26).

When employing the inductance cable, place several layers of Turkish towelling about the torso around gall bladder area and then 1 full turn of inductance cable (actually 1¾ turns of cable) around this towelling.

Frontal Sinus. — Place 2"x4½" condenser pad electrode on two layers of heavy towelling on forehead, lower edge on line with eyebrow. Bind snugly with bandage passed around the head. Have patient sit on or place a large electrode on back.

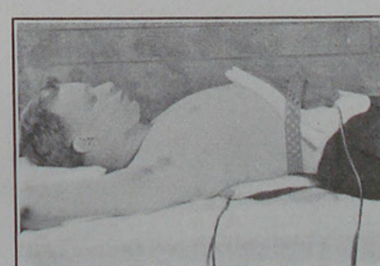


Fig. 26. Electrodes for treatment of gall bladder. Pads above and below held by bandage.

Another method is to place a special sinus electrode over the sinus area, using several thick-

Fig. 27. Air-spaced electrode application to frontal sinus.

Fig. 28. Sinus electrode. Padding under electrode to absorb moisture. Air-spaced electrodes also may be used.

nesses of absorbent padding. This electrode is held in place with a bandage placed around the head. Have patient sit on or place a 5″x8″ electrode on back. Figure 27 illustrates a sinus application with air-spaced electrodes. Figure 28 shows use of a special pad electrode.

Fingers, Hand or Wrist.—Have a patient sit on large pad electrode (or at back). Place three or four inches of padding on patient's lap with medium sized pad electrode on

Fig. 29. Arrangement with pads for heating fingers and hand. Indifferent electrode at back.

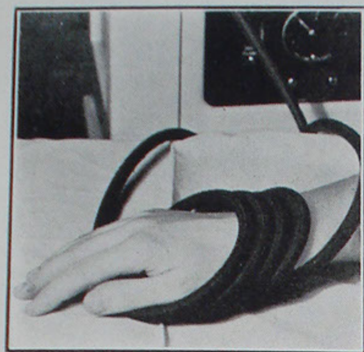


Fig. 30. Cable application to fractured wrist. Two or more coils suffice. Towelling may be used.

top, place finger or fingers in contact with this; in this manner the heat can be concentrated to the very finger tips by placing them only in contact; increasing the contact area, the heat will appear farther up to include the hand or wrist. Covering the part with a towel will confine the heat (Fig. 29). Cable applications to wrist as in Figure 30 are very effective.

Neck (anterior). — Place medium sized pad electrode over several layers of towelling on throat (anterior). Have patient lie on or sit with back against the large electrode — towelling between it and patient. Bind electrodes snugly but not tight.

Fig. 31. Cable arrangement for treatment of the neck.

Neck (posterior). — Place medium sized pad electrode over several layers of towelling on back of neck. Place 5½"x8½" condenser pad electrode on about four layers of towelling on chest. The above will result in deep heat; for lesser depth effect, use the large electrode as the indifferent one, towelling between it and the patient. Bind electrodes snugly. Figure 31 illustrates use of inductance cable for treatment of the neck.

Ear (one only). — Place medium sized pad electrode on about four layers of heavy padding touching on side of ear from

base of skull to cheek over ear to be treated. Bind this in place with a bandage passing under the chin and over the head twice and around back of and under base of skull and over the ear a couple of turns, holding both ends of this electrode snugly in place. Place a large pad electrode on the opposite side of the body undergoing treatment, preferably under the arm. Place towelling between arm and pad to keep the arm from touching the electrode.

Ears (both). — Place a medium sized pad electrode over four layers of Turkish towelling on each side of the head from base of the skull to the cheek. A towel may be folded into a narrow strip, four thicknesses and passed across the back of the head and over the ears with the electrodes placed over it, then the whole is bound in place with a bandage, passed under the chin and over the head twice, then around the back of and under the base of the skull until the electrodes are snugly bound in place. A special mastoid electrode may be placed back of ear making sure that the hook part of the electrode is hooked over the top of the ear (Fig. 32). Place several thicknesses of padding between the electrode and the patient. This electrode is held in place by a bandage.

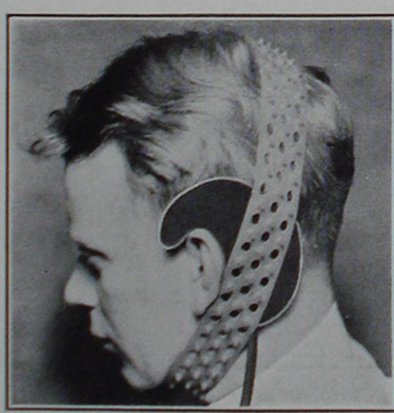


Fig. 32. Mastoid electrode to ear. Held by bandage. Padding under electrode.

Fever Therapy (Hyperpyrexia). — The patient, with all clothing removed, is placed on a bed (free of springs or at least for a distance of six inches) on which are three woolen blankets over a rubber sheet. The patient is wrapped in the blankets and rubber sheet, making sure that they are tucked

in snugly around the feet. Then place a Turkish towel around the neck and tuck the blankets in tight, securing the arms inside the blankets so that the HEAD ONLY is left exposed. A FISCHER Rantos Bag may be used in fever therapy. The patient is put into this bag which closes with zipper arrangement. Openings are provided for inserting thermometers. The bag increases convenience in giving fever treatments.

Place one 5″x40″ belt electrode around the thighs and another of the same size about the waist, securing them in place with elastic bandages (Fig. 33). The electrodes are then connected to the short wave apparatus. A rise of temperature should be noted in approximately twenty to thirty minutes.

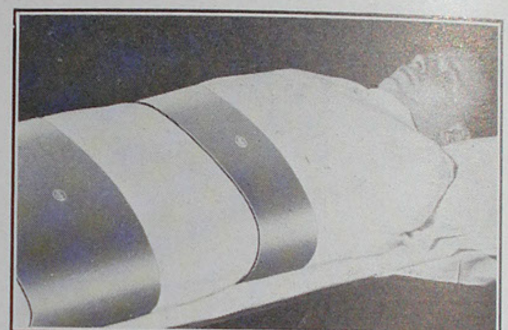


Fig. 33. Arrangement with large cuff electrodes to produce artificial fever.

When the inductance cable is used for fever therapy, the preparation of the patient is exactly the same (Fig. 34). The only difference is that 3 or 4 thicknesses of towelling (or Terry cloth) are placed around the patient's waist and the inductance cable is wound twice around the patient's waist (actually 1¾ turns).

Fig. 34. Arrangement of inductance cable to produce artificial fever.

After the desired temperature is reached, the current can be shut off and turned on for approximately three minutes out of every fifteen minutes, which, in most cases, will maintain an even temperature.

Temperature, pulse, and respiration should be taken every fifteen minutes, or oftener if necessary. The patient can be given fluids such as orange juice, lemonade or water, as often as requested. NEVER give fluids to a patient until after the temperature has been taken. The administration of fever treatments is not recommended as an office procedure.

Electrosurgical Tissue-Cutting. — Place the patient in contact with one of the large condenser electrodes connected to the short wave unit. The cutting electrode and handle are connected with the proper patient's outlet.

A clean incision with little or no lateral dehydration is obtained from practically the same setting of the machine controls as a cut with much side dehydration. The speed of the moving blade controls this factor to a great degree. The faster the blade is moved, the cleaner the cut; contrarily, if the blade is moved slowly through the tissues, dehydration will result. It will be found that in many instances no indifferent electrode is required for sectioning, the patient's body providing sufficient capacity for the operating blade with one cord. The patient may also sit or lie upon a large condenser pad as the indifferent electrode. For dissection the current should be turned on with the foot switch before touching the patient with the active electrode. If cutting proceeds too slowly, use more current. If too fast, use less current (Fig. 35).

Fig. 35. Electrosurgical tissue-cutting.

Electrocoagulation. — Select either pointed or ball applicator as the active electrode, which is held in an insulated handle and connected to patient's outlet (Fig. 36). Some tests will prove of value in first determining the amount of coagulation obtainable at various settings. It will be found that no indifferent electrode is required for electrocoagulation. The patient's body provides sufficient capacity, and the point or ball alone with just one cord

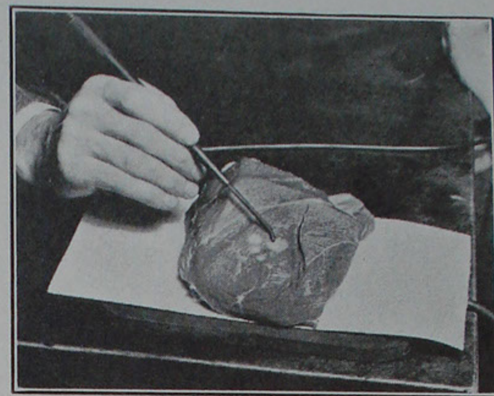


Fig. 36. Electrocoagulation.

and handle will prove adequate, or the indifferent electrode may be placed on the floor near the base of the apparatus. In early attempts at electrocoagulation, or when very delicate work is to be done, a perfect pre-setting can be obtained by testing the coagulating strength of the current on a piece of fresh beef lying in proximity to the part to be coagulated.

ADDENDA

SHORT WAVE APPARATUS

Model "SWDI"

THIS model offers physicians the opportunity to select the wave length preferred — 6, 12, 18 or 24 meters — and, provides, except with the 6-meter wave length, use of the inductance cable — a result accomplished by interchangeable oscillator units. Any physician, hospital, clinic, obviously can have additional wave lengths from the same cabinet by using additional oscillator units. The inductance cable plugs directly into outlets in the control panel, special outlets. Unit gives superb results with either cuff, pad, orificial electrodes or inductance cable. Power is greater than will ever be needed. This Model "SWDI" is recommended to physicians as the last word in short wave apparatus design and performance. It will meet every demand for short wave applications.

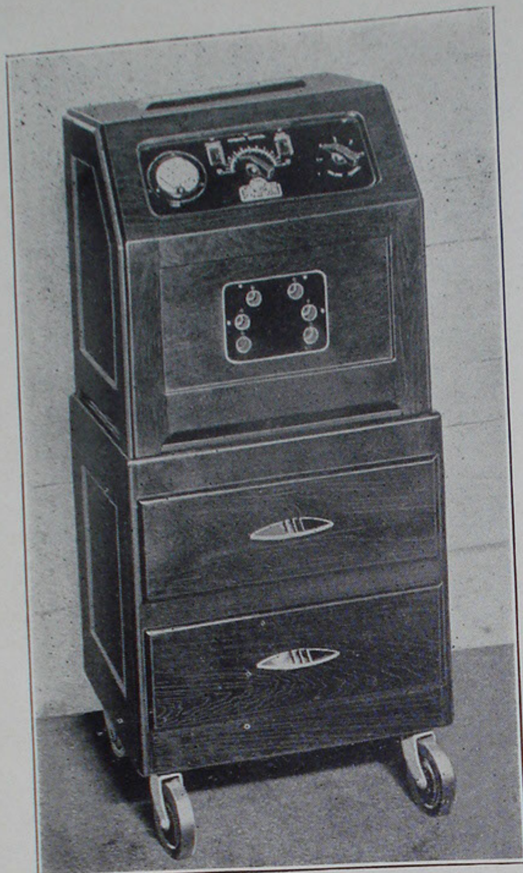
FEATURES OF STRUCTURE - OPERATION

1. Choice of wave length you prefer — 6, 12, 18 or 24 meters — including inductance cable (except with a 6-meter wave length).
2. More than ample power for all short wave applications. Heating accomplished rapidly.
3. A 12-point volume control and the patient's vernier control permit applications at any power level from zero to maximum.
4. Six patient's outlets — four for cuff, pad and orificial electrodes, two for cable — afford greatest flexibility of application.
5. Four FISCHER-built tubes, especially heavy and durable, assure tube dependability and economy. Tube circuit balanced.
6. Electro-surgical (coagulation) and tissue-cutting currents available — no additional attachments needed.
7. Optional finish — mahogany or ivory. Metal parts chromium.

Cat. No.		Code	Price
3940	FISCHER Model "SWDI" complete with accessories and inductance cable	YAAFO	$480.00

Necessary to indicate wave length wanted.

(Ask for descriptive pamphlet, Form 1562C)



Model "SWI-12"

FISCHER Model "SWI-12" is recommended where a moderately priced outfit is desired. This model is intermediate in wave length and power — with sufficient power, however, for any short wave application, including electropyrexia, electro-surgery (coagulation) and electro-surgical, tissue-cutting. Construction is of the chassis type. Four tubes — 2 rectifiers, 2 power — are used. Every advanced feature of short wave construction has been included in the design. Unit operates equally well with pad, cuff or insulated orificial type electrodes. Cable applications also provided. Backed by the usual FISCHER guarantee of satisfactory performance. The unit will stand up under hardest usage and give long years of efficient service.

Features of STRUCTURE-OPERATION

1. Sufficient power for all applications — whether the area to be heated is large or small.
2. FISCHER-built tubes — of special heavy design. Their performance is notably superior to the regular tubes in general use.
3. Patient's outlets — four for pad, cuff and orificial electrodes, two for inductance cable.
4. Patient's control — a vernier control, operating in conjunction with the five point volume control. Together, these two controls assure the continual increase of current in patient from zero to maximum or a like decrease.
5. Electro-surgery currents — no accessories are needed — the various electrodes plug directly into patient's outlets.
6. Advanced construction — construction of Model "SWI-12" is of the chassis type. Finish optional — mahogany or ivory.

Cat. No.		Code	Price
3900B	FISCHER Model "SWI-12," complete with accessories and inductance cable	DAGHL	$395.00

(Ask for descriptive pamphlet Form 1591)

Portable Models

H. G. FISCHER & COMPANY offer two models in short wave apparatus — Model "USW-6" and Model "SW-12" — producing waves of 6 and 12 meters, respectively. Each unit is very substantially built and will give thoroughly dependable performance. Construction is of the well-known FISCHER design. Applications may be made with cuff, pad or insulated orificial condenser electrodes. Cable applications not possible.

Cat. No.		Code	Price
3835B	FISCHER Model "USW-6"	SACTT	$315.00
3840A	FISCHER Model "SW-12"	DAGCE	315.00

(Ask for descriptive pamphlet, form 1576A)

Model "CSWI"

Combination Cabinet

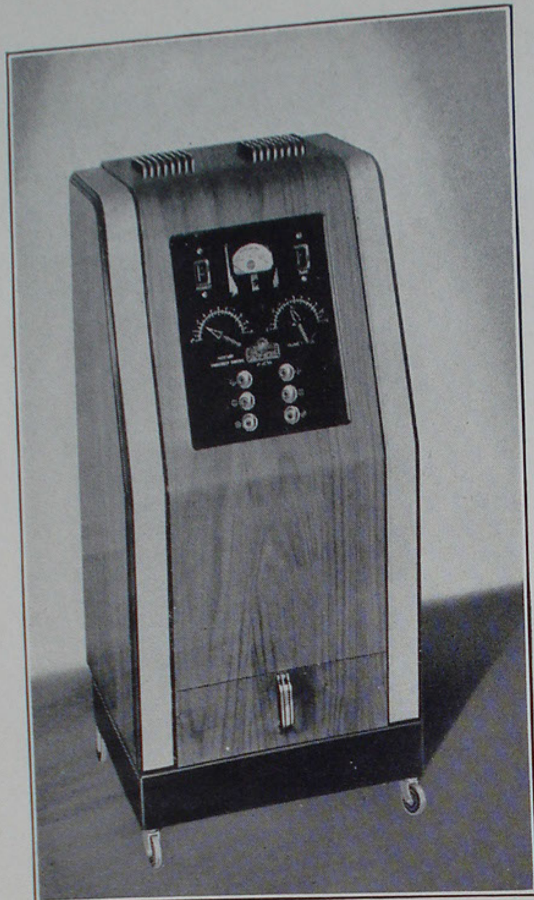
DESIGNED especially for eye, ear, nose and throat specialists, but equally valuable for physicians who want such facilities, this new FISCHER unit offers the very latest in conveniences. Combined in one cabinet are a motor and two-cylinder pump providing tankless compressed air for nebulizers, atomizers, pressure, suction, and vibration. There is also a true galvanic current, desiccation and coagulation, cautery, a diagnostic circuit, all necessary attachments, and short wave. The latter is our FISCHER Model "SWI-12," described elsewhere. Necessary accessories are included. Among construction features worthy of comment, are the fine cabinet, the bakelite panels, drawer space for accessories and supplies, mobility, and guaranteed performance. The finish is optional — mahogany or cream ivory. Metal parts are chromium plated.

Features of STRUCTURE - OPERATION

1. The short wave unit embodied in this Combination Cabinet provides all short wave applications. Both electro-coagulating and tissue-cutting currents are available. Electrodes plug directly into patient's outlets.
2. Galvanism. This is a straight line, galvanic current, perfectly smooth and under very fine control.
3. Desiccation (fulguration). Power is adjustable, ample, current unipolar, high voltage, low amperage.
4. Cautery. Actual, low voltage, high amperage, under fine control.
5. Diagnostic circuit. Illuminates bulb furnished with cabinet. Will illuminate most any bulb used for diagnostic purposes.
6. Suction and suction-vibration. Under fine control. Produces about 14.5 vacuum. Pressure and pressure-vibration. Pressure up to 26 lbs. Finish optional — mahogany or ivory. Metal parts chromium.

Cat. No.		Code	Price
3912B	FISCHER Model "CSWI" Combination Cabinet	DAGMR	$665.00
4020	FISCHER Model "CSWI" with separable base	SADMM	680.00

(Ask for descriptive pamphlet Form 1581A)



Model "C"

FISCHER Model "C" is designed especially for the general practitioner, whose short wave requirements may be limited, also for those who regard price a consideration. It is almost as powerful a unit as Model "SWI-12," but housed in a different cabinet. With the exception of therapeutic fever, which it will maintain only under favorable conditions, it affords all short wave applications — with cuff, pad, air-spaced and insulated orificial electrodes and inductance cable. It is beautifully finished. Backed by the usual FISCHER guarantee of satisfactory performance. This model will stand up under hardest usage and give long years of efficient service.

Features of STRUCTURE-OPERATION

1. Ample power for all applications. (For fever therapy we recommend larger model).
2. Four FISCHER-built tubes of heavy design. Tube performance is guaranteed.
3. Six patient's outlets — four for condenser electrodes, two for cable.
4. Five (vernier control) permitting applications of power at any level from zero to maximum.
5. Electrosurgery currents for electrosurgical tissue-cutting and electrocoagulation are available.

Cat. No.		Code	Price
4015	FISCHER Model "C" Short Wave Apparatus with set of cuff, pad, electrodes and inductance cable	TAIEF	$315.00

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H. G. FISCHER & COMPANY is one of the largest manufacturers of X-ray and electrotherapeutic apparatus. FISCHER equipment is known today and used the world around. More than 50,000 physicians, dentists, hospitals and universities in the United States use FISCHER equipment — evidence that FISCHER apparatus can be thoroughly relied upon. Further, the fact that H. G. FISCHER & COMPANY distributes its products through its own trained, direct, factory representatives, not only enables the purchaser to get a great deal more per dollar expended by way of efficient and durable equipment, but at the same time assures to him an extraordinarily high quality of service from trained men. Our comparatively small overhead expense and direct factory representation enable us to give purchaser such value per dollar expended as cannot be equalled by any competitor in the field. The FISCHER name assures long years of efficient service.

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